

*Signals and Geometrics Section*

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# Signals & Geometrics

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# Traffic Signal Trivia

(Traffic Signals have a colourful history)

- The first traffic signal was installed in London, England in 1868.
- The first electrical traffic signal was installed in Cleveland, Ohio in 1914.
- Garrett Augustus Morgan, Sr., an African-American inventor, invented the nation's first "patented" three position (stop, go, and all-directional stop) traffic signal in 1922.
- In 1925 as an extraordinary display of diplomacy towards young Irish lads, the City of Syracuse put the green indication on top at one traffic signal.



# Traffic Signal Trivia

(now closer to home)

- There are approximately 7,700 traffic signals along the State Highway System.
- The NCDOT maintains approximately 4,400 traffic signals.
- Approximately 42% of the traffic signals under NCDOT jurisdiction are in a coordinated traffic signal system.



# *Advantages and Disadvantages of Traffic Signals*

By providing alternate right of way to various traffic movements, traffic signals exert a profound influence on traffic flow.



# *Advantages and Disadvantages of Traffic Signals (cont.)*

Properly designed, located, operated, and maintained traffic signals will have the following advantages:

- provision of an orderly movement of traffic;
- reduction of conflicts between vehicular movements and between vehicular and pedestrian movements;
- reduction of the frequency of certain type accidents, especially right-angle collisions;
- coordination to provide for nearly continuous movement of traffic at a definite speed along a given route; and
- interruption of heavy traffic flows to permit other traffic, vehicular or pedestrian, to enter or cross a roadway.



# *Advantages and Disadvantages of Traffic Signals (cont.)*

Improper or unjustified traffic signals, or poorly designed or improperly maintained traffic signals can result in the following disadvantages:

- excessive delay;
- disobedience of signal indications;
- increased use of less adequate routes as road users attempt to avoid signals;
- significant increases of the frequency of certain type collisions, especially rear-end collisions;
- reduction of gaps, especially on undivided highways;
- reduced intersection capacity; and
- increased congestion and emissions.



# *What does the Signals & Geometrics Section do?*

- Provides for safe movement of motorists and pedestrians at signalized intersections and along congested corridors.
- Develops signal plans and project special provisions.
- Coordinates with Highway Design and Traffic Control on signal related project requirements.
- Develops signal timing for new isolated signals and traffic signal systems.
- Researches, designs, and implements traffic signal and transportation system plans.



## *Additional responsibilities include:*

- Establishes policies, procedures, and standards for traffic signals and signal systems to ensure conformance with nationwide Federal guidelines and Motor Vehicle Laws of North Carolina.
- Provides expertise and representation on Section 4 - Highway Traffic Signals of the national Manual on Uniform Traffic Control Devices (MUTCD).
- Provides expertise and develops Section 4 of the North Carolina Supplement to the MUTCD.



- Work on Projects Statewide (from Murphy to Manteo).

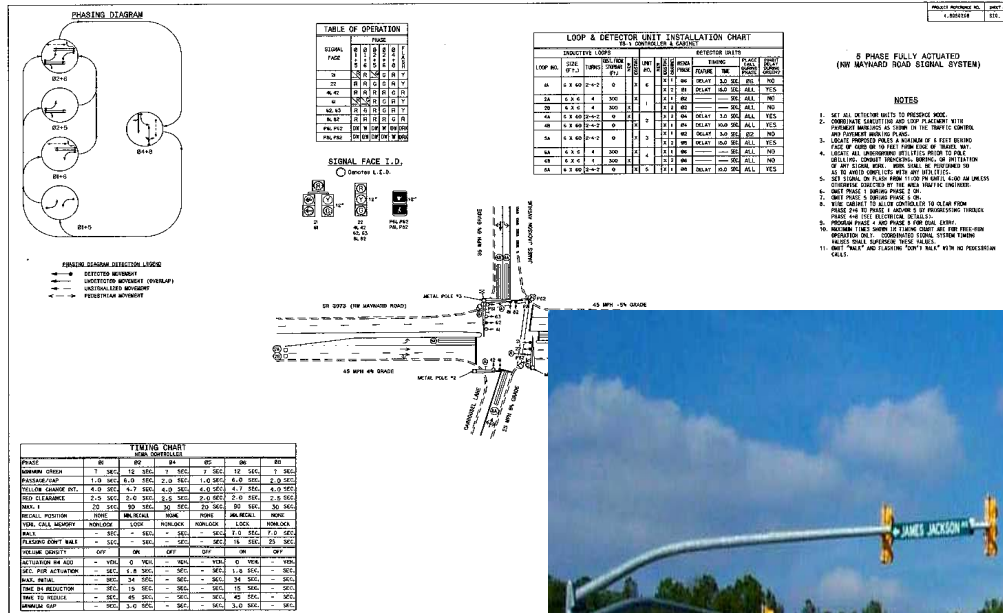


- Work with citizens, public officials, municipalities, divisions, and many different units of DOT:
  - Roadway Design
  - Traffic Control
  - Construction
  - Structure Design
  - Signing
  - Highway Divisions
  - Other DOT units

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# Final Signal Designs



# *Field Implementation of Timing Plans*

After signal construction or upgrade is completed, new system timing plans are programmed into the controller. Then the effects of coordination are observed.



# The Safety Group:

- Designs solutions to address immediate safety issues within the Spot Safety and High Hazard Elimination Programs.
- Develops and prepares signal plans and equipment requisitions for new and upgraded traffic signals.
- Develops and prepares intersection geometric revisions.

# Safety Group projects include:



- Spot Safety
- Division Request
- Small Urban
- Statewide Contingency

# The Contracts Group:

- Designs and develops signal plans and project special provisions for Transportation Improvement Program (TIP) Projects.
- Designs and develops Closed Loop Signal System Projects (such as Senate Bill 1005).
- Negotiates for services and reviews signal designs for Private Engineering Firms (PEF).

# The Systems Group:

- Designs, develops, installs and field adjusts signal system timing for new and upgraded traffic signal systems.
- Reviews new signal system equipment and software.
- Provides technical assistance and training to field personnel.
- Provides traffic modeling software expertise in the areas of traffic signal operations.

# The Special Projects Group

- Designs and develops NC Moving Ahead Projects.
- Designs and develops developer/city projects, or reviews developer/city projects where plans are completed by others.
- Designs and develops traffic signal head upgrade plans.
- Prepares and maintains plan of records for traffic signal improvements.

# The Special Projects Group projects include:

- Railroad projects.
- Metal pole structural design issues.
- Maintaining the NCDOT Signals & Geometrics Design Manual.
- Developing and maintaining Section 4 - Highway Traffic Signals of the North Carolina supplement to the MUTCD.
- Creating design policies and guidelines.

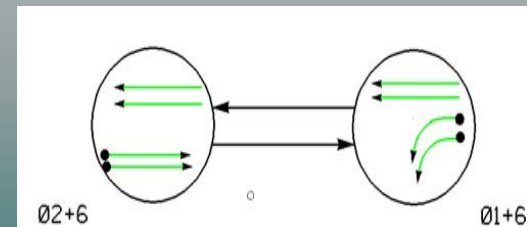
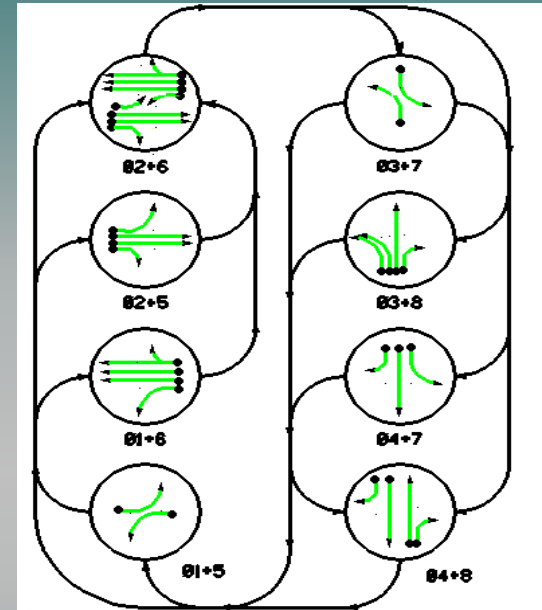
# Field Survey

A field survey and field investigation is performed, or data from other design branches is used, to generate a base map of the intersection.



# Traffic Signal Phasing

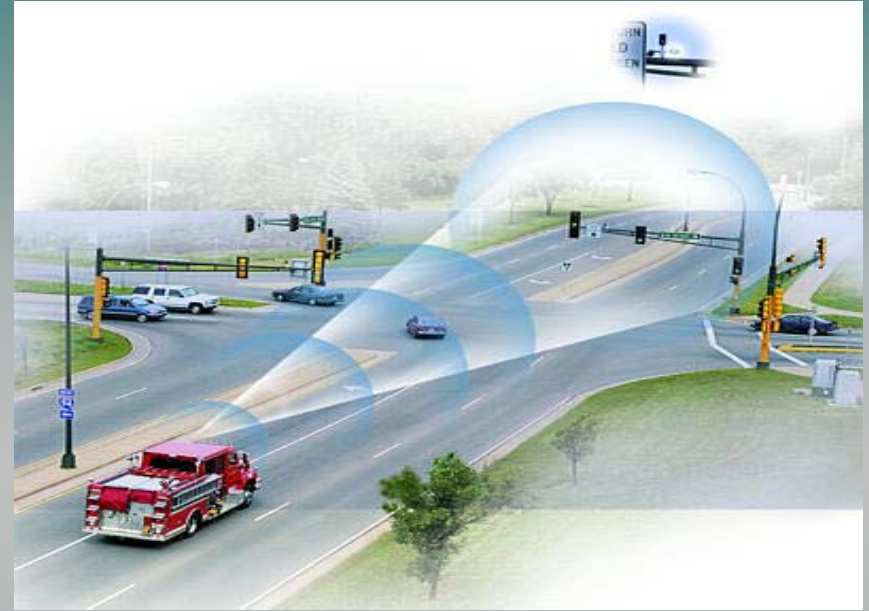
- A signal phase is that part of a cycle length allocated to a traffic movement(s) receiving the right-of-way.
- Signal phasing is determined using traffic counts, accident history, sight distance limitations, recommendations from field personnel and traffic modeling software.
- In determining the number of phases for a traffic signal, the goals of safety and capacity may be in conflict.



# Traffic Signal Preemption

## Railroad

## Emergency Vehicle / Bus



- Typically, necessary wherever a railroad-highway crossing is located within 200 feet of a traffic signal.
- Requires extensive coordination with Railroad Company and Division/City.

- Types of Preemption
  - Pushbutton in firehouse
  - Optical Detection
  - Siren Detection
- Coordination with Division/City.



# *Coordinated Traffic Signal Systems*

- Provides progressive traffic flow
- Provides immediate notification of equipment malfunctions to a central control center
- Requires communication links between intersection cabinets and central control center
- Operators can control and monitor any intersection within the system from the central control center
- Operators can coordinate with the Intelligent Transportation Systems Operations Unit to provide incident management traffic signal system timing plans along major corridors for natural or man-disasters.



For More Information  
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